EPA/AMD/R08-03/016
2003

EPA Superfund
Record of Decision Amendment:

CENTRAL CITY, CLEAR CREEK
EPA ID: COD980717557
OU 03
IDAHO SPRINGS, CO
09/22/2003

Colorado Department of Public Health and Environment

FINAL

CLEAR CREEK/CENTRAL CITY SUPERFUND SITE

Amendment to the Operable Unit 3 Record of Decision

For the

Burleigh Tunnel Discharge

Prepared in Cooperation with the United States Environmental Protection Agency

Region VIII

Denver, Colorado

Prepared by

James D. Lewis

Colorado Department of Public Health and Environment

June 5, 2003

DECLARATION PAGE

The Clear Creek/Central City Superfund Site Phase II Remedial Investigation identified the Burleigh Tunnel discharge as the primary source of metals loading to Clear Creek in the Silver Plume Mining District, Silver Plume, Colorado. Elevated zinc concentrations associated with the discharge were considered a threat to aquatic life in Clear Creek below the tunnel. The Operable Unit 3 Record of Decision (September 30, 1991) selected passive treatment to address the Burleigh Tunnel discharge.

Construction of a pilot scale wetland system was completed at the Burleigh Tunnel portal in 1993. After three years of operation and data collection, it was concluded that a number of factors prevented the system from efficiently removing dissolved zinc. The system was allowed to operate for a total of six years and was decommissioned in 1999. The discharge was allowed to infiltrate into the subsurface, replicating the condition of the discharge in 1993.

Annual high-flow and low-flow surface water monitoring conducted between 1999 arid 2001 indicate that the in-stream concentrations of dissolved zinc below the Burleigh Tunnel are significantly less than the aquatic stream standard for dissolved zinc. Additionally, the Town of Silver Plume does not extract water for domestic use from either ground water or surface water within the town limits. Therefore, the Burleigh Tunnel discharge does not pose a threat to human health or the environment.

According to the regulations of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), CDPHE, in preparation for this amendment to the Operable Unit 3 Record of Decision, compiled a Burleigh Tunnel discharge Remedial Investigation and Feasibility Study Report as an addendum to the 1989 Clear Creek/Central City Superfund Site Phase II Remedial Investigation Report. The purpose of the Remedial Investigation portion of the addendum was to present recent Clear Creek zinc concentration data below the Burleigh Tunnel and to compare the recent data with historic Clear Creek dissolved zinc concentrations in the vicinity of the Burleigh Tunnel. The Feasibility Study portion of addendum evaluated potential remedial action alternatives, including the No Action Alternative. A Proposed Plan generated from the Burleigh Tunnel Remedial Investigation and Feasibility Study addendum, issued April 21, 2003, was submitted to the public and other government entities for review and comment for the required 30- day period. Copies of the Proposed Plan were provided for review at the Silver Plume Post Office, at the Clear Creek County Court House in Georgetown, at the Idaho Springs Town Hall, and at the CDPHE Record Center in Denver, Colorado. Additionally, CDPHE held a public meeting to present the Proposed Plan on May 5,2003, at the Georgetown Community Center.

CDPHE and EPA selected the No Action Alternative with annual high-flow and low-flow surface water monitoring as the remedial action alternative for the Burleigh Tunnel. Data collected from this monitoring will be presented as annual reports and a Five-Year review report will be compiled from the annual reports. Data collection will begin June 2003 and continue until June 2008 with annual reports and a Five-Year Review report being compiled from the annual data reports.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate. Because this alternative will result in zinc contamination remaining on site, a data review will be conducted after five years to ensure that the selected alternative continues to provide adequate protection of human health and the environment. If the surface water monitoring data indicates a significant and continued degradation to the water quality of Clear Creek related to the Burleigh Tunnel discharge, the agencies will evaluate the implementation of one of the other two alternatives presented in the Burleigh Tunnel discharge Feasibility Study.

SIGNATURE PAGE

For The United States Environmental Protection Agency

Max Dodson, Assistant Regional Administrator, Office of Ecosystems Protection and Remediation

Date: 9/22/03

For The Colorado Department of Public Health and Environment

Howard Roitman, Director of Environmental Programs

Date: 8-9-03

AMENDMENT

TO THE

OPERABLE UNIT 3 RECORD OF DECISION

BURLEIGH TUNNEL DISCHARGE

CLEAR CREEK/CENTRAL CITY SUPERFUND SITE

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

The Clear Creek Central City Superfund Investigation Area encompasses the Clear Creek watershed and the historic mining activities associated with the portion of the Colorado Mineral Belt that intersects the watershed. The historic mining activities impacted the water quality of Clear Creek and its tributaries. In response to these impacts, a Phase I Clear Creek/Central City Remedial Investigation and Feasibility Study was conducted in 1985 in the Idaho Springs and the Black Hawk/Central City areas.

A Phase II Clear Creek/Central City Remedial Investigation and Feasibility Study was implemented in 1989. The Phase II investigation broadened the original Phase I area to include the entire Clear Creek watershed above Golden, Colorado to the Continental Divide. It was concluded from the Phase II data that the Burleigh Tunnel discharge, located at the western end of Silver Plume, Colorado, represented a source of dissolved zinc loading to Clear Creek and that the exceedance of the Clear Creek dissolved zinc standard below the Burleigh Tunnel was attributable to the inflow of this discharge to Clear Creek. As a result, treatment of the discharge was proposed as a remedial action alternative in the Phase II Feasibility Study and wetland technology was specified to address the discharge in the Clear Creek/Central City Operable Unit 3 Record of Decision. The preferred remedial action selected to address the Burleigh discharge was passive treatment utilizing constructed wetland technology.

A pilot scale wetland system was constructed at the Burleigh Tunnel in 1993. After three years of operation and data collection, the agencies concluded that a number of factors prevented the system from efficiently removing dissolved zinc from the Burleigh discharge. The wetlands were decommissioned 1999. At that time, the wetland flow control valve system was inadvertently broken, and the discharge infiltrated into the subsurface in the area under the footprint of the former system.

Annual high-flow and low-flow surface water monitoring was implemented in 1999 on Clear Creek below the Burleigh Tunnel to assess if the discharge was entering Clear Creek through the alluvial system between the Burleigh Tunnel and Clear Creek. This monitoring continued through 2001. Since the decommissioning of the wetlands in 1999, dissolved zinc concentrations in Clear Creek immediately below the Burleigh Tunnel have declined and no longer exceed the Clear Creek aquatic stream standard

Pursuant to § 117 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and § 300.43 5 ©(2)(ii) of the National contingency Plan (NCP), CDPHE, in preparation for this amendment to the Operable Unit 3 Record of Decision, compiled a Burleigh Tunnel discharge Remedial Investigation and Feasibility Study Report as an addendum to the 1989 Clear Creek/ Central City Superfund Site Phase II Remedial Investigation Report. The purpose of the Remedial Investigation portion of the addendum was to present recent Clear Creek zinc concentration data below the Burleigh Tunnel and to compare the recent data with historic Clear Creek dissolved zinc concentrations in the vicinity of the Burleigh Tunnel. The Feasibility Study portion of addendum evaluated potential remedial action alternatives including the No Action Alternative. A Proposed Plan generated from the Burleigh Tunnel Remedial Investigation and Feasibility Study addendum, issued April 21, 2003, was submitted to the public and other government entities for review and comment for the required 30-day period. Copies of the Proposed Plan were provided for review at the Silver Plume Post Office, at the Clear Creek County Court House in Georgetown, at the Idaho Springs Town Hall, and at the CDPHE Record Center in Denver, Colorado. Additionally, CDPHE held a public meeting to present the Proposed Plan on May 5, 2003 at the Georgetown Community Center.

This amendment to the Operable Unit 3 Record of Decision for the Burleigh Tunnel discharge has been prepared on the basis that data collected between 1999 and 2001 indicates that, currently, the Burleigh Tunnel discharge does not pose a threat to human health or the environment. CDPHE and EPA have, therefore, selected the No Action Alternative as the selected remedial action alternative for the Burleigh Tunnel.

This amendment to the Operable Unit 3 Record of Decision will become a part of the Administrative Record in accordance with § 300.825(a)(2) of the NCP. The Administrative Record for the Clear Creek/ Central City Superfund Site is located at the CDPHE Record Center:

4300 Cherry Creek Drive South
Building B2
Denver, Colorado 80222

2.0 SITE HISTORY

The Clear Creek watershed incorporates the Clear Creek/Central City Superfund Investigation Area and the historic mining activities associated with the Colorado Mineral Belt where the watershed and the mineral belt intersect. The water quality of the watershed is compromised by metals contamination from acid mine drainage discharging from historic mine tunnels to Clear Creek and its tributaries, from diffuse ground water metals loadings associated with flooded underground mine workings, and from mine waste piles located adjacent to the flows in Clear Creek and its tributaries. As a result, the EPA included the watershed on the Interim National Priority List (NPL) in 1982. In 1983 it was retained on the final NPL.

A Phase I Clear Creek/Central City Remedial Investigation and Feasibility Study was conducted in 1985 in the Idaho Springs and the Black Hawk/Central City areas by Camp Dresser and McKee, Inc (CDM) for EPA. This investigation focused on discharges and mining-related wastes associated with the Big 5 Tunnel and ARGO Tunnel located in Idaho Springs, Colorado, and the National Tunnel, Quartz Hill Tunnel in Central City, Colorado, and the Gregory Incline in Black Hawk, Colorado. The Phase I Feasibility Study was completed in August 1988.

A Phase II Clear Creek/Central City Remedial Investigation and Feasibility study was implemented in 1989 by CDM for the Colorado Department of Health, known now as the Colorado Department of Public Health and Environment (CDPHE), which was designated the role of lead agency in 1988. The Phase II investigation broadened the original Phase I area to include the approximately 400 square mile Clear Creek watershed above Golden, Colorado. The Phase II Remedial Investigation was completed in September 1990 and the draft Phase II Feasibility Study submitted to the public for comment in June 1991.

The Clear Creek Central City Superfund Investigation Area was divided into four Operable Units for the purpose of addressing specific sources of metals contamination.

Operable Unit 1 was designated to evaluate treatment of the acid mine drainage from the National, Gregory Incline, Quartz Hill, ARGO, and Big Five Tunnel discharges. The Feasibility Study for Operable Unit 1 was completed in 1987 and a Record of Decision was signed in September 1987. The Record of Decision selected passive treatment of the discharging acid mine water as the preferred remedial alternative. If it was determined that passive treatment was not effective, the Record of Decision allowed the flexibility for active treatment. Active treatment of the ARGO Tunnel discharge has been effective in reducing metals loading to Clear Creek.

Operable Unit 2 was designated to address mine tailings and waste rock associated with the discharging tunnels referenced above. The Feasibility Study for Operable Unit 2 was completed in November 1987, and a Record of Decision was signed in March 1988. The Record of Decision selected run-on control and slope stabilization as the preferred remedial alternative. Remedial action of the mill tailings at the Gregory Incline and the waste rock at the Big 5 Tunnel has been completed. Stabilization efforts at the Big 5 waste pile and the removal of the Gregory Incline tailings has been effective in reducing metals loading to both Clear Creek and the North Fork of Clear Creek, respectively.

Operable Unit 3 was originally designated to address control of surge events from the ARGO Tunnel pursuant to the Phase I investigation. However, Operable Unit 3 was redesignated to include a final decision for surge events from the ARGO Tunnel; the Virginia Canyon ground water metals loading that impacts the water quality of Clear Creek; remediation of several mine waste rock piles; a decision on the Big 5 Tunnel discharge; and the Burleigh Tunnel discharge based upon the results of the Phase II investigation. The Operable Unit 3 Record of Decision was signed on September 30, 1991. The preferred remedial action plan selected to address the Burleigh Tunnel discharge was passive treatment utilizing constructed wetland technology. This

document amends the Operable Unit 3 Record of Decision for the Burleigh Tunnel discharge.

Operable Unit 4 was designated in 1999 and includes sediment control on the North Fork of Clear Creek as well and tributaries to the North Fork, waste rock piles in Virginia Canyon, Clear Creek mainstem waste rock piles, an on-site repository to consolidate mine waste rock, and the North Fork and mainstem Clear Creek Remedial Investigation/Feasibility Study. A Record of Decision for this operable unit will be compiled upon completion of the Operable Unit 4 Remedial Investigation/Feasibility Study.

2.1 BURLEIGH TUNNEL HISTORY

The Burleigh Tunnel, which was identified as a source of zinc loading under the Operable Unit 3 Record of Decision, is located at the western end of the Silver Plume Mining District in Silver Plume, Colorado. The Burleigh Tunnel was constructed as a drainage and haulage tunnel for the mines of the Silver Plume Mining District. At the time of the 1989 Phase II Remedial Investigation, the discharge from the Burleigh Tunnel flowed through an open channel that extended to the south from the portal of the tunnel. The discharge disappeared into the underlying alluvial deposits and mine waste rock at the end of the channel and discharged to Clear Creek as diffuse flow between boulders lining the north bank of Clear Creek. At the time of the 1989 Phase II investigation, the low-flow concentration of dissolved zinc in the discharge was 50,200 micra-grams per liter (µg/L). This equates to a dissolved zinc load of 19.5 pounds per day (lb/D) based upon a discharge rate of 0.072 cubic feet per second (cfs). The Phase II Clear Creek instream concentration of dissolved zinc measured immediately below the Burleigh Tunnel was 384 µg/L, which exceeded the Clear Creek aquatic life chronic stream standard of
200 µg/L.

The selected alternative as presented in the Operable Unit 3 Record of Decision called for passive treatment of the Burleigh Tunnel discharge utilizing constructed wetland technology. It was assumed that the passive treatment technology could remove 99.5 percent of the dissolved zinc from the Burleigh Tunnel discharge.

3.0 BASIS FOR THE OPERABLE UNIT 3 AMENDMENT FOR THE BURLEIGH TUNNEL DISCHARGE

In August of 1993, pursuant to the Operable Unit 3 Record of Decision, a passive treatment system was constructed as a pilot scale wetland demonstration project at the portal of the Burleigh Tunnel. After three years of operation and data collection, it was concluded that a number of factors prevented the system from meeting the 99.5 percent zinc removal efficiency that was initially assumed. Over time, the removal efficiency dropped to less than fifty percent. These factors included: (1) restricted biological activity during the winter, (2) increased concentrations of dissolved oxygen during spring adversely affected the anaerobic conditions of the system, and (3) inconsistencies in the hydraulics of the wetlands created fluctuations in the residence time of the discharge in the wetland reducing zinc removal. As a result, passive wetland treatment of the Burleigh discharge was no longer considered a viable option.

One of the wetland bioreactors operated until 1996 and was decommissioned in 1998. The second bioreactor was operated until 1999 and was decommissioned the same year. After the decommissioning of the second bioreactor in May 1999, the discharge was allowed to infiltrate into the contaminated subsurface in the area under the footprint of the wetland system. These conditions reflect the conditions at the Burleigh Tunnel prior to the construction of the wetland in 1993.

Annual high-flow and low-flow surface water monitoring was implemented in 1999 on Clear Creek below the Burleigh Tunnel to assess if the discharge was recharging Clear Creek and if a recharge was occurring if it was impacting the water quality of Clear Creek. The monitoring program was extended in 2000 through Silver Plume to the Georgetown Reservoir in 2000, a distance of approximately 3.5 miles. This monitoring was continued through 2001. Since the decommissioning of the wetland in 1999, the concentrations of dissolved zinc in Clear Creek immediately below the Burleigh Tunnel have consistently been below the Clear Creek aquatic

standard of 200 µg/L.

The basis for the Operable Unit 3 amendment for the Burleigh Tunnel discharge is the fundamental changes regarding the discharge and its impact to the water quality of Clear Creek including the fact that the discharge no longer reports to Clear Creek as a point source and in-stream concentrations of dissolved zinc in Clear Creek below the Burleigh Tunnel, at this time, are less than the Clear Creek aquatic stream standard of 200 µg/L.

4.0 DESCRIPTION OF THE PREFERRED ALTERNATIVE

The Remedial Action Alternative presented in the Operable Unit 3 Record of Decision included the following elements: "combined institutional controls and runoff barriers for mine waste piles at active mill sites, and soil capping of the other mine waste piles with passive treatment of the Burleigh Tunnel, and active treatment of the ARGO Tunnel discharge including ground water in the area of the ARGO Tunnel".

The agencies selected alternative for the Burleigh Tunnel, as presented in the Burleigh Tunnel Proposed Plan, is the No Action Alternative. Under the No Action alternative no remedial action would be undertaken to address the Burleigh Tunnel discharge. The discharge would continue to infiltrate into the Clear Creek alluvium as it currently does. It is anticipated that zinc stream standards below the Burleigh Tunnel would continue to be met as a result of natural attenuation processes.

Under this alternative, the Silver Plume Mining District including the Burleigh Tunnel and the Georgetown Reservoir would be monitored in conjunction with Clear Creek basin-wide performance monitoring. The sampling would be conducted semi-annually, with one event in the fall and the second event in early summer. An annual, monitoring report would be compiled for the two events, and these reports will provide the basis for a five-year review report.

Applicable or Relevant and Appropriate Requirements (ARARs) are either legally applicable or relevant and appropriate environmental standards. Applicable requirements are those requirements that are standards specific to the hazardous substances, location, and/or contemplated remedial action and that would be legally applicable if the response actions were not undertaken pursuant to CERCLA. Applicable requirements must be met to the full extent required by law. Relevant and appropriate requirements are those requirements that address problems or situations sufficiently similar to those encountered at the site that their use is well suited, but for which the jurisdictional prerequisites have not been met.

A detailed ARARs analysis was performed for the Burleigh Tunnel discharge Feasibility Study. The reader is referred to the Burleigh Tunnel Feasibility Study Addendum Report for a detailed review of the ARARs analysis, in the case of the Burleigh Tunnel discharge, the primary ARAR to be considered is the Clear Creek Segment 2 water quality stream standard of 200 µg/L for dissolved zinc. Therefore, this standard represents the remedial action objective that would have to be met under any alternative selected to address the Burleigh Tunnel discharge. To the extent that the Segment 2 ARAR is currently met immediately below the Burleigh Tunnel, it is the judgment of CDPHE and EPA that a No Action Alternative is warranted, as treatment of the Burleigh Tunnel discharge would not result in a marked improvement to the water quality of Clear Creek below the Burleigh Tunnel.

5.0 EVALUATION OF ALTERNATIVES

Nine criteria are utilized to evaluate the difference between the Operable Unit 3 Selected Alternative and the Operable Unit 3 Amended Preferred Alternative. This section of the Amendment profiles the relative performance of each alternative against the nine criteria, noting how one alternative compares with the other alternative under consideration. The nine evaluation criteria are discussed below. The "Detailed Analysis of Alternatives" can be found in the Burleigh Tunnel Feasibility Study Addendum Report.

COMPARISON OF ALTERNATIVES BASED ON THE NINE EVALUATION CRITERIA		
CRITERIA	Operable Unit 3 Selected Alternative Constructed Wetland	Operable Unit 3 Amended Preferred Alternative No Action
Overall Protection	Technology was not protective of the environment as the technology did not remove zinc from the discharge and zinc loading to Clear Creek was not addressed	The No Action Alternative is protective of the environment as natural attenuation has reduced dissolved zinc concentrations to levels below the Clear Creek standard
Compliance with ARARs	Passive treatment would not meet ARARs	The No Action Alternative only attains the ARAR for the Clear Creek aquatic stream standard.
Long-Term Effectiveness	Passive treatment is not a viable technology at the Burleigh Tunnel and would not meet Long-Term Effectiveness requirement	It is anticipated that the No Action Alternative will meet the Long Term Effectiveness requirement due to natural attenuation. If not, the agencies will consider other alternatives if required.
Reduction in Toxicity, Mobility, and Volume	Reduction in Toxicity, Mobility, and Volume was inefficient and did not meet design expectations	The No Action Alternative will not reduce the volume or mobility of the discharge. However, the toxicity of the discharge is currently mitigated through natural attenuation.
Short-Term Effectiveness	Passive treatment would not meet Short-Term Effectiveness requirement	The Preferred Alternative does meet the Short-Term Effectiveness requirement Due to natural attenuation of the discharge.
Implementability	Difficult to Implement due to overall acreage requirements and technical problems.	The requirements for the implementation of the No Action Alternative include the equipment necessary to conduct the surface water sampling and a laboratory to perform the water quality analysis on the samples.
Cost	$3,500,000 to $4,000,000 for a full-scale treatment system for thirty years (CDM 1994 estimate).	$175,384 for monitoring, laboratory analysis, and reporting for five years.
Supporting Agency Acceptance	EPA concurred with Selected Alternative and the construction and operation of the pilot scale wetland	The EPA as the supporting agency concurs with the Preferred Alternative without comment

6.0 SUPPORT AGENCY COMMENTS

The EPA has reviewed the Burleigh Tunnel discharge Remedial Investigation and Feasibility Addendum to the Phase II Remedial Investigation and Feasibility Study, the Burleigh Tunnel discharge Proposed Plan, and this Amendment to the Operable Unit 3 Record of Decision. EPA concurs with the decision of a No Action Alternative for the Burleigh Tunnel discharge.

7.0 STATUTORY DETERMINATIONS

In general, under CERCLA 42 U.S.C. § 9621 (CERCLA § 121)(b)(l), "remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment". However, to the extent that the in-stream concentrations of dissolved zinc in Clear Creek below the Burleigh Tunnel are less than the Clear Creek aquatic stream standard of 200 µg/L the agencies feel that treatment of the Burleigh Tunnel discharge is not warranted at this time. Therefore, § 121(b)(l) of CERCLA is not applicable.

Pursuant to CERCLA 42 U.S.C. § 9621 (CERCLA § 121)(c), "if a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, a review of the remedial action no less than five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented". Although the Preferred Alternative is the No Action Alternative and does not include a specific remedial action, semi- annual surface water monitoring of the Clear Creek watershed including the Silver Plume Mining District and Burleigh Tunnel discharge will be implemented for a five-year period to assess the overall water quality of Clear Creek of the watershed and the water quality of Clear Creek between Silver Plume and the Georgetown Reservoir. The results of this monitoring will be compiled into annual surface water reports. The requirement will be met and the annual surface water monitoring reports will be performed and a five-year review report of the surface water data compiled as required.

In compliance with CERCLA 42 U.S.C. § 9621 (CERCLA § 121)(d)(l), "remedial actions selected under this section or otherwise required or agreed to under this chapter shall attain a degree of remediation of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment. Such remedial actions shall be relevant and appropriate under the circumstances presented by the release or threatened release of such substance, pollutant, or contaminant". The degree of remediation required for this action would be the Clear Creek Segment 2 water quality stream standard for dissolved zinc of 200 µg/L, which is the most limiting ARAR for the remedial action. At this time the Clear Creek Segment 2 water quality stream standard is attained immediately below the Burleigh Tunnel and § 121(d)(l) of CERCLA is met.

8.0 PUBLIC PARTICIPATION

Pursuant to the public participation requirements set forth in § 300.435(c)(2)(ii) of the NCP, CDPHE executed the requirements under items A through H of § 300.435(c)(2)(ii) with respect to this Amendment to the 1991 Operable Unit 3 Record Of Decision.

Appendix A provides the CDPHE response to comments, criticisms, and relevant material submitted by the public and other governmental agencies during the 30 day public comment period.

Two comments were received within the thirty-day comment period, which extended from April 21, 2003 through May 21, 2003. Ms. Claudia Cupp and Mr. John Calhoun of Silver Plume, Colorado provided one of the comments; and, Mr. Mark Levin of Idaho Springs, Colorado, provided the second comment.

APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

1. Comment received from Ms. Claudia Cupp and Mr. John Calhoun:

The comment received from these two residents of Silver Plume addressed the cost of the Silver Plume Mining District and Clear Creek Monitoring at $175,384.00.

Sufficient detail was not provided in the Proposed Plan to explain how the above referenced cost was calculated. It was only specified that the monitoring that was $175,384. The detail was provided in Appendix 1 of the Burleigh Tunnel Feasibility Study in the worksheet for the monitoring costs.

The $175,384 represents the net present value of the monitoring for a 30-year term and a rate of 7.5 percent with an annual cost of $32,479.00.

2. Comment received from Mr. Mark Levin:

The comment received from Mr. Levin of Idaho Springs expresses his concern regarding the potential of a sludge destabilization underground that could result in a high volume surge event as the iron hydroxide, with associated metals, releases in a short-term surge.

Iron hydroxide [Fe(OH)3] results from the oxidation and dissolution of pyrite (FeS2) in the presence of air and water. The pyrite is associated with ore bodies and varies in abundance with each ore body. Pyrite, although associated with the lead-zinc-silver ores of the Silver Plume Mining District, is not as pronounced as the pyrite of the quartz pyrite copper-gold veins of the Freeland-Lamartine and especially the Idaho Springs Mining Districts.

Historic 1989 Phase II Remedial Investigation high-flow and low-flow total iron concentrations for the ARGO, Big 5, McClelland and Rockford Tunnels are presented at the end of this response. The total iron concentrations presented are a reflection of the concentration of iron hydroxide in the mine discharges.

For example, the 1989 high-flow and low-flow total iron concentration in the Burleigh discharge was 264 µg/L and 253 µg/L, respectively. In comparison, the 1989 high-flow and low-flow total iron concentrations for the ARGO Tunnel discharge were 100,000 µg/L and 130,000 µg/L, respectively. The average of the high-flow and low-flow total iron concentrations in the ARGO Tunnel discharge are over 400 times greater than the average of the high-flow and low-flow total iron concentrations in the Burleigh Tunnel discharge.

Prior to construction of the ARGO Tunnel Treatment Plant, the iron hydroxide in the ARGO discharge was approximately 2 feet thick outside of the portal of the ARGO Tunnel. In contrast, there is no iron hydroxide associated with the Burleigh Tunnel discharge as evidenced by the lack of iron hydroxide in the influent control structure where the Burleigh discharge is retained prior to infiltration into the subsurface. Additionally, CDPHE and EPA contractors conducted an inspection of the Burleigh Tunnel prior to the construction of the Burleigh Tunnel passive treatment system to ascertain if it was necessary to install an iron hydroxide removal system to avoid "plugging" of the hydraulics of the wetland system. Iron hydroxide was not observed within the Burleigh Tunnel itself and this observation in conjunction with low total iron concentrations associated with the Burleigh discharge eliminated the requirement for iron removal.